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PATENT APPLICATION OF

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ENTITLED

THEFT PREVENTION DEVICE FOR AUTOMOTIVE VEHICLE SERVICE CENTERS

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THEFT PREVENTION DEVICE FOR AUTOMOTIVE VEHICLE SERVICE CENTERS

BACKGROUND OF THE INVENTION

The present invention relates to portable tools of the type used in automotive vehicle service centers. More specifically, the present invention relates to a theft prevention device used to prevent theft of portable tools from the automotive vehicle service centers.

Portable tools in automotive service centers have a variety of applications. Some portable tools can be used to test various components of an automobile such that problems associated with the automobile can be diagnosed. For example, storage batteries used in automotive vehicles, both electrical vehicles and vehicles with internal combustion engines, as well as power supplies such as backup power systems are often tested in an automotive service center. It is desirable to measure the condition of such storage batteries with a portable battery tester. For example, it can be useful to determine the amount of charge a storage battery can hold (i.e. the capacity of the battery) or the state of health of a storage battery.

A number of battery testing techniques are known in the art. These techniques include measuring the specific gravity of acid contained in a storage battery. Measuring a battery voltage and performing a load test on a battery in which a large load is

placed on the battery and the response observed. More recently, a technique has been pioneered by Dr. Keith S. Champlin and Midtronics, Inc. of Willowbrook, Illinois for testing storage batteries by measuring the conductance of the batteries. This technique is described in a number of United State patents, for example, 3,873,911, issued March 25, 1975, to Champlin, entitled ELECTRONIC BATTERY TESTING DEVICE; U.S. Patent No. 3,909,708, issued September 30, 1975, to Champlin, entitled ELECTRONIC BATTERY TESTING DEVICE; U.S. Patent No. 4,816,768, issued March 28, 1989, to Champlin, entitled ELECTRONIC BATTERY TESTING DEVICE; U.S. Patent No. 4,825,170, issued April 25, 1989, to Champlin, entitled ELECTRONIC BATTERY TESTING DEVICE WITH AUTOMATIC VOLTAGE SCALING; U.S. Patent No. 4,881,038, issued November 14, 1989, to Champlin, entitled ELECTRONIC BATTERY TESTING DEVICE WITH AUTOMATIC VOLTAGE SCALING TO DETERMINE DYNAMIC CONDUCTANCE; U.S. Patent No. 4,912,416, issued March 27, 1990, to Champlin, entitled ELECTRONIC BATTERY TESTING DEVICE WITH STATE-OF-CHARGE COMPENSATION; U.S. Patent No. 5,140,269, issued August 18, 1992, to Champlin, entitled ELECTRONIC TESTER FOR ASSESSING BATTERY/CELL CAPACITY; U.S. Patent No. 5,343,380, issued August 30, 1994, entitled METHOD AND APPARATUS FOR SUPPRESSING TIME VARYING SIGNALS IN BATTERIES UNDERGOING CHARGING OR DISCHARGING; U.S. Patent No. 5,572,136, issued November 5, 1996, entitled ELECTRONIC BATTERY TESTER WITH AUTOMATIC COMPENSATION FOR LOW

STATE-OF-CHARGE; U.S. Patent No. 5,574,355, issued November 12, 1996, entitled METHOD AND APPARATUS FOR DETECTION AND CONTROL OF THERMAL RUNAWAY IN A BATTERY UNDER CHARGE; U.s. Patent No. 5,585,416, issued December 10, 1996, entitled APPARATUS AND METHOD FOR STEP-CHARGING BATTERIES TO OPTIMIZE CHARGE ACCEPTANCE; U.S. Patent No. 5,585,728, issued December 17, 1996, entitled ELECTRONIC BATTERY TESTER WITH AUTOMATIC COMPENSATION FOR LOW STATE-OF-CHARGE; U.S. Patent No. 5,589,757, issued December 31, 1996, entitled APPARATUS AND METHOD FOR STEP-CHARGING BATTERIES TO OPTIMIZE CHARGE ACCEPTANCE; U.S. Patent No. 5,592,093, issued January 7, 1997, entitled ELECTRONIC BATTERY TESTING DEVICE LOOSE TERMINAL CONNECTION DETECTION VIA A COMPARISON CIRCUIT; U.S. Patent No. 5,598,098, issued January 28, 1997, entitled ELECTRONIC BATTERY TESTER WITH VERY HIGH NOISE IMMUNITY; U.S. Patent No. 5,656,920, issued August 12, 1997, entitled METHOD FOR OPTIMIZING THE CHARGING LEAD-ACID BATTERIES AND AN INTERACTIVE CHARGER; U.S. Patent No. 5,757,192, issued May 26, 1998, entitled METHOD AND APPARATUS FOR DETECTING A BAD CELL IN A STORAGE BATTERY; U.S. Patent No. 5,821,756, issued October 13, 1998, entitled ELECTRONIC BATTERY TESTER WITH TAILORED COMPENSATION FOR LOW STATE-OF-CHARGE; U.S. Patent No. 5,831,435, issued November 3, 1998, entitled BATTERY TESTER FOR JIS STANDARD; U.S. Patent No. 5,914,605, issued June 22, 1999, entitled ELECTRONIC BATTERY TESTER; U.S. Patent No. 5,945,829, issued August 31, 1999, entitled

MIDPOINT BATTERY MONITORING; U.S. Patent No. 6,002,238, issued December 14, 1999, entitled METHOD AND APPARATUS FOR MEASURING COMPLEX IMPEDANCE OF CELLS AND BATTERIES; U.S. Patent No. 6,037,751, issued March 14, 2000, entitled APPARATUS FOR CHARGING BATTERIES; U.S. Patent No. 6,037,777, issued March 14, 2000, entitled METHOD AND APPARATUS FOR DETERMINING BATTERY PROPERTIES FROM COMPLEX IMPEDANCE/ADMITTANCE; U.S. Patent No. 6,051,976, issued April 18, 2000, entitled METHOD AND APPARATUS FOR AUDITING A BATTERY TEST; U.S. Patent No. 6,081,098, issued June 27, 2000, entitled METHOD AND APPARATUS FOR CHARGING A BATTERY; U.S. Patent No. 6,091,245, issued July 18, 2000, entitled METHOD AND APPARATUS FOR AUDITING A BATTERY TEST; U.S. Patent No. 6,104,167, issued August 15, 2000, entitled METHOD AND APPARATUS FOR CHARGING A BATTERY; U.S. Patent No. 6,137,269, issued October 24, 2000, entitled METHOD AND APPARATUS FOR ELECTRONICALLY EVALUATING THE INTERNAL TEMPERATURE OF AN ELECTROCHEMICAL CELL OR BATTERY; U.S. Patent No. 6,163,156, issued December 19, 2000, entitled ELECTRICAL CONNECTION FOR ELECTRONIC BATTERY TESTER; U.S. Patent No. 6,172,483, issued January 9, 2001, entitled METHOD AND APPARATUS FOR MEASURING COMPLEX IMPEDANCE OF CELL AND BATTERIES; U.S. Patent No. 6,172,505, issued January 9, 2001, entitled ELECTRONIC BATTERY TESTER; U.S. Patent No. 6,222,369, issued April 24, 2001, entitled METHOD AND APPARATUS FOR DETERMINING BATTERY PROPERTIES FROM COMPLEX IMPEDANCE/ADMITTANCE; U.S. Patent No. 6,225,808, issued

May 1, 2001, entitled TEST COUNTER FOR ELECTRONIC BATTERY TESTER; U.S. Patent No. 6,249,124, issued June 19, 2001, entitled ELECTRONIC BATTERY TESTER WITH INTERNAL BATTERY; U.S. Patent No. 6,259,254, issued July 10, 2001, entitled APPARATUS AND METHOD FOR CARRYING OUT DIAGNOSTIC TESTS ON BATTERIES AND FOR RAPIDLY CHARGING BATTERIES; U.S. Patent No. 6,262,563, issued July 17, 2001, entitled METHOD AND APPARATUS FOR MEASURING COMPLEX ADMITTANCE OF CELLS AND BATTERIES; U.S. Patent No. 6,294,896, issued September 25, 2001; entitled METHOD AND APPARATUS FOR MEASURING COMPLEX SELF-IMMITANCE OF A GENERAL ELECTRICAL ELEMENT; U.S. Patent No. 6,294,897, issued September 25, 2001, entitled METHOD AND APPARATUS FOR ELECTRONICALLY EVALUATING THE INTERNAL TEMPERATURE OF AN ELECTROCHEMICAL CELL OR BATTERY; U.S. Patent No. 6,304,087, issued October 16, 2001, entitled APPARATUS FOR CALIBRATING ELECTRONIC BATTERY TESTER; U.S. Patent No. 6,310,481, issued October 30, 2001, entitled ELECTRONIC BATTERY TESTER; U.S. Patent No. 6,313,607, issued November 6, 2001, entitled METHOD AND APPARATUS FOR EVALUATING STORED CHARGE IN AN ELECTROCHEMICAL CELL OR BATTERY; U.S. Patent No. 6,313,608, issued November 6, 2001, entitled METHOD AND APPARATUS FOR CHARGING A BATTERY; U.S. Patent No. 6,316,914, issued November 13, 2001, entitled TESTING PARALLEL STRINGS OF STORAGE BATTERIES; U.S. Patent No. 6,323,650, issued November 27, 2001, entitled ELECTRONIC BATTERY TESTER; U.S. Patent No. 6,329,793, issued December 11, 2001,

entitled METHOD AND APPARATUS FOR CHARGING A BATTERY; U.S. Patent No. 6,331,762, issued December 18, 2001, entitled ENERGY MANAGEMENT SYSTEM FOR AUTOMOTIVE VEHICLE; U.S. Patent No. 6,332,113, issued December 18, 2001, entitled ELECTRONIC BATTERY TESTER; U.S. Patent No. 6,351,102, issued February 26, 2002, entitled AUTOMOTIVE BATTERY CHARGING SYSTEM TESTER; U.S. Patent No. 6,359,441, issued March 19, 2002, entitled ELECTRONIC BATTERY TESTER; U.S. Patent No. 6,363,303, issued March 26, 2002, entitled ALTERNATOR DIAGNOSTIC SYSTEM, U.S. Patent No. 6,392,414, issued May 21, 2002, entitled ELECTRONIC BATTERY TESTER; U.S. Patent No. 6,417,669, issued July 9, 2002, entitled SUPPRESSING INTERFERENCE IN AC MEASUREMENTS OF CELLS, BATTERIES AND OTHER ELECTRICAL ELEMENTS; U.S. Patent No. 6,424,158, issued July 23, 2002, entitled APPARATUS AND METHOD FOR CARRYING OUT DIAGNOSTIC TESTS ON BATTERIES AND FOR RAPIDLY CHARGING BATTERIES; U.S. Patent No. 6,441,585, issued August 17, 2002, entitled APPARATUS AND METHOD FOR TESTING RECHARGEABLE ENERGY STORAGE BATTERIES; U.S. Patent No. 6,445,158, issued September 3, 2002, entitled VEHICLE ELECTRICAL SYSTEM TESTER WITH ENCODED OUTPUT; U.S. Patent No. 6,456,045, issued September 24, 2002, entitled INTEGRATED CONDUCTANCE AND LOAD TEST BASED ELECTRONIC BATTERY TESTER; U.S. Patent No. 6,466,025, issued October 15, 2002, entitled ALTERNATOR TESTER; U.S. Patent No. 6,466,026, issued October 15, 2002, entitled PROGRAMMABLE CURRENT EXCITER FOR MEASURING AC IMMITTANCE OF CELLS AND BATTERIES; U.S.

Patent No. 6,534,993, issued March 18, 2003, entitled ELECTRONIC BATTERY TESTER; U.S. Patent No. 6,544,078, issued April 8, 2003, entitled BATTERY CLAMP WITH INTEGRATED CURRENT SENSOR; U.S. Patent No. 6,556,019, issued April 29, 2003, entitled ELECTRONIC BATTERY TESTER; U.S. Patent No. 6,566,883, issued May 20, 2003, entitled ELECTRONIC BATTERY TESTER; U.S. Patent No. 6,586,941, issued July 1, 2003, entitled BATTERY TESTER WITH DATABUS; U.S. Patent No. 6,597,150, issued July 22, 2003, entitled METHOD OF DISTRIBUTING JUMP-START BOOSTER PACKS; U.S. Serial No. 09/780,146,filed February 9, 2001, entitled STORAGE BATTERY WITH INTEGRAL BATTERY TESTER; U.S. Serial No. 09/756,638, filed January 8, 2001, entitled METHOD AND APPARATUS FOR DETERMINING BATTERY PROPERTIES FROM COMPLEX IMPEDANCE/ADMITTANCE; U.S. Serial No. 09/862,783, filed May 21, 2001, entitled METHOD AND APPARATUS FOR TESTING CELLS AND BATTERIES EMBEDDED IN SERIES/PARALLEL SYSTEMS; U.S. Serial No. 09/960,117, filed September 20, 2001, entitled IN-VEHICLE BATTERY MONITOR; U.S. Serial No. 09/908,278, filed July 18, 2001, entitled BATTERY CLAMP WITH EMBEDDED ENVIRONMENT SENSOR; U.S. Serial No. 09/880,473, filed June 13, 2001; entitled BATTERY TEST MODULE; U.S. Serial No. 09/940,684, filed August 27, 2001, entitled METHOD AND APPARATUS FOR EVALUATING STORED CHARGE IN AN ELECTROCHEMICAL CELL OR BATTERY; U.S. Serial No. 60/330,441, filed October 17, 2001, entitled ELECTRONIC BATTERY TESTER WITH RELATIVE TEST OUTPUT; U.S. Serial No. 60/348,479, filed October

29, 2001, entitled CONCEPT FOR TESTING HIGH POWER VRLA BATTERIES; U.S. Serial No. 10/046,659, filed October 29, 2001, entitled ENERGY MANAGEMENT SYSTEM FOR AUTOMOTIVE VEHICLE; U.S. Serial No. 09/993,468, filed November 14, 2001, entitled KELVIN CONNECTOR FOR A BATTERY POST; U.S. Serial No. 09/992,350, filed November 26, 2001, entitled ELECTRONIC BATTERY TESTER, U.S. Serial No. 60/341,902, filed December 19, 2001, entitled BATTERY TESTER MODULE; U.S. Serial No. 10/042,451, filed January 8, 2002, entitled BATTERY CHARGE CONTROL DEVICE, U.S. Serial No. 10/073,378, filed February 8, 2002, entitled METHOD AND APPARATUS USING A CIRCUIT MODEL TO EVALUATE CELL/BATTERY PARAMETERS; U.S. Serial No. 10/093,853, filed March 7, 2002, entitled ELECTRONIC BATTERY TESTER WITH NETWORK COMMUNICATION; U.S. Serial No. 60/364,656, filed March 14, 2002, entitled ELECTRONIC BATTERY TESTER WITH LOW TEMPERATURE RATING DETERMINATION; U.S. Serial No. 10/098,741, filed March 14, 2002, entitled METHOD AND APPARATUS FOR AUDITING A BATTERY TEST; U.S. Serial No. 10/112,114, filed March 28, 2002; U.S. Serial No. 10/109,734, filed March 28, 2002; U.S. Serial No. 10/112,105, filed March 28, 2002, entitled CHARGE CONTROL SYSTEM FOR A VEHICLE BATTERY; U.S. Serial No. 10/112,998, filed March 29, 2002, entitled BATTERY TESTER WITH BATTERY REPLACEMENT OUTPUT; U.S. Serial No. 10/119,297, filed April 9, 2002, entitled METHOD AND APPARATUS FOR TESTING CELLS AND BATTERIES EMBEDDED IN SERIES/PARALLEL SYSTEMS; U.S. Serial No. 60/379,281,

filed May 8, 2002, entitled METHOD FOR DETERMINING BATTERY STATE OF CHARGE; U.S. Serial No. 60/387,046, filed June 7, 2002, entitled METHOD AND APPARATUS FOR INCREASING THE LIFE OF A STORAGE BATTERY; U.S. Serial No. 10/177,635, filed June 21, 2002, entitled BATTERY CHARGER WITH BOOSTER PACK; U.S. Serial No. 10/207,495, filed July 29, 2002, entitled KELVIN CLAMP FOR ELECTRICALLY COUPLING TO A BATTERY CONTACT; U.S. Serial No. 10/200,041, filed July 19, 2002, entitled AUTOMOTIVE VEHICLE ELECTRICAL SYSTEM DIAGNOSTIC DEVICE; U.S. Serial No. 10/217,913, filed August 13, 2002, entitled, BATTERY TEST MODULE; U.S. Serial No. 60/408,542, filed September 5, 2002, entitled BATTERY TEST OUTPUTS ADJUSTED BASED UPON TEMPERATURE; U.S. Serial No. 10/246,439, filed September 18, 2002, entitled BATTERY TESTER UPGRADE USING SOFTWARE KEY; U.S. Serial No. 60/415,399, filed October 2, 2002, entitled QUERY BASED ELECTRONIC BATTERY TESTER; and U.S. Serial No. 10/263,473, filed October 2, 2002, entitled ELECTRONIC BATTERY TESTER WITH RELATIVE TEST OUTPUT; U.S. Serial No. 60/415,796, filed October 3, 2002, entitled QUERY BASED ELECTRONIC BATTERY TESTER; U.S. Serial No. 10/271,342, filed October 15, 2002, entitled IN-VEHICLE BATTERY MONITOR; U.S. Serial No. 10/270,777, filed October 15, 2002, entitled PROGRAMMABLE CURRENT EXCITER FOR MEASURING AC IMMITTANCE OF CELLS AND BATTERIES; U.S. Serial No. 10/310,515, filed December 5, 2002, entitled BATTERY TEST MODULE; U.S. Serial No. 10/310,490, filed December

5, 2002, entitled ELECTRONIC BATTERY TESTER; U.S. Serial No. 10/310,385, filed December 5, 2002, entitled BATTERY TEST MODULE, U.S. Serial No. 60/437,255, filed December 31, 2002, entitled REMAINING TIME PREDICTIONS, U.S. Serial No. 60/437,224, filed December 31, 2002, entitled DISCHARGE VOLTAGE PREDICTIONS, U.S. Serial No. 10/349,053, filed January 22, 2003, entitled APPARATUS AND METHOD FOR PROTECTING A BATTERY FROM OVERDISCHARGE, U.S. Serial No. 10/388,855, filed March 14, 2003, entitled ELECTRONIC BATTERY TESTER WITH BATTERY FAILURE TEMPERATURE DETERMINATION, U.S. Serial No. 10/396,550, filed March 25, 2003, entitled ELECTRONIC BATTERY TESTER, U.S. Serial No. 60/467,872, filed May 5, 2003, entitled METHOD FOR DETERMINING BATTERY STATE OF CHARGE, U.S. Serial No. 60/477,082, filed June 9, 2003, entitled ALTERNATOR TESTER, U.S. Serial No. 10/460,749, filed June 12, 2003, entitled MODULAR BATTERY TESTER FOR SCAN TOOL, U.S. Serial No. 10/462,323, filed June 16, 2003, entitled ELECTRONIC BATTERY TESTER HAVING A USER INTERFACE TO CONFIGURE A PRINTER, U.S. Serial No. 10/601,608, filed June 23, 2003, entitled CABLE FOR ELECTRONIC BATTERY TESTER, U.S. Serial No. 10/601,432, filed June 23, 2003, entitled BATTERY TESTER CABLE WITH MEMORY; U.S. Serial No. 60/490,153, filed July 25, 2003, entitled SHUNT CONNECTION TO A PCB FOR AN ENERGY MANAGEMENT SYSTEM EMPLOYED IN AN AUTOMOTIVE VEHICLE, U.S. Serial No. 10/653,342, filed September 2, 2003, entitled ELECTRONIC BATTERY TESTER CONFIGURED TO PREDICT A LOAD

TEST RESULT, U.S. Serial No. 10/654,098, filed September 3, 2003, entitled BATTERY TEST OUTPUTS ADJUSTED BASED UPON BATTERY TEMPERATURE AND THE STATE OF DISCHARGE OF THE BATTERY, U.S. Serial No. 10/656,526, filed September 5, 2003, entitled METHOD AND APPARATUS FOR MEASURING A PARAMETER OF A VEHICLE ELECTRICAL SYSTEM, U.S. Serial No. 10/656,538, filed September 5, 2003, entitled ALTERNATOR TESTER WITH ENCODED OUTPUT, which are incorporated herein in their entirety.

The theft of portable devices, especially portable electronic devices, continues to be a widespread problem. Portable tools used by technicians in automotive vehicle service centers are generally mobile as well as expensive. The service center environment is often chaotic and includes a large quantity of people arriving and departing. Portable tools can easily be stolen without notice of those managing or working at the center.

SUMMARY OF THE INVENTION

An apparatus and method for preventing theft in automotive vehicle service centers includes a transmitter configured to transmit a wireless security signal which defines a perimeter. At least one portable tool having a receiver configured to receive the transmitted security signal. Security circuitry is actuated if the tool is outside and/or near the perimeter defined by the security signal.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1-1 is a simplified block diagram of a theft prevention device prior to a theft in accordance with an embodiment of the present invention.

FIG. 1-2 is a simplified block diagram of the theft prevention device of FIG. 1-1 after the theft has occurred in accordance with an embodiment of the present invention.

FIG. 2-1 is a simplified block diagram of a theft prevention device prior to a theft in accordance with an embodiment of the present invention.

FIG. 2-2 is a simplified block diagram of the theft prevention device of FIG. 2-1 after the theft has occurred in accordance with an embodiment of the present invention.

FIG. 3 is a simplified block diagram of an automotive vehicle service center in accordance with an embodiment of the present invention.

FIG. 4 is a simplified block diagram of an automotive vehicle service center in accordance with an embodiment of the present invention.

FIG. 5 is a simplified block diagram of an electronic battery tester in accordance with embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1-1 is a simplified block diagram of theft prevention device 100 prior to a theft in accordance with an embodiment of the present invention. Device 100 includes transmitter 104 configured to transmit a wireless security signal 106 that defines a perimeter. Device 100 also includes a receiver 108 embedded in portable tool 102 and operably coupled to security circuitry 110. Security signal 106 can be encoded with a key such that secure communication can take place between transmitter 104 and portable tool 102. The key can be randomly changeable to ensure secure communication. Security signal 106 can also transmit other information besides defining a perimeter. Examples of other information include software updates for the portable tool, messages for the operator and time updates.

Receiver 108 is configured to receive the transmitted security signal 106. If portable tool 102 remains located within the perimeter defined by the wireless security signal, then proper use and/or storage of portable tool 102 is being practiced within an automotive vehicle service center. If, however, portable tool 102 is carried outside the perimeter, a theft has occurred. For example, non-receipt of security signal 106 by receiver 108 can indicate that portable tool 102 is outside of the perimeter. In another example, receipt of security signal 106 having a signal strength less than a

predetermined minimum signal strength can indicate that portable tool 102 is outside the perimeter. In FIG. 1-1, transmitter 104 is in communication with receiver 108 and the strength of security signal 106 is greater than the predetermined minimum signal strength. Therefore, portable tool 102 is located within the perimeter defined by security signal 106 and is in proper use.

FIG. 1-2 is a simplified block diagram of theft prevention device 100 of FIG. 1-1 after the theft has occurred in accordance with an embodiment of the present invention. Portable tool 102 includes an output 112 operably coupled to security circuitry 110 and tool transmitter 114 operably coupled to security circuitry 110. Portable tool 102 also includes an internal power source 140 configured to supply power to security circuitry 110 such that portable tool can receive security signal 106, output the continuous audible noise and transmit theft signal 116. As illustrated in FIG. 1-2, transmitter 104 has either lost communication with receiver 108 or security signal 106 is less than the predetermined minimum signal strength. Therefore, a theft has occurred because portable tool 102 has been carried outside of the perimeter defined by security signal 106.

When a theft occurs, security circuitry 110 is configured to disable portable tool 102 causing the tool to become inoperable. For example, security circuitry 110 can disable portable tool 102 after the

portable tool has been outside of the perimeter for a predetermined period of time. Waiting the predetermined period of time prevents portable tool 102 from disabling if there was a temporary interruption in security signal 106. In addition, security circuitry 110 instructs output 112 to emit a continuous audible noise. This continuous audible noise will alert service center employees that portable tool 102 has been stolen and alert others outside of the service center. Furthermore, when portable tool 102 is carried outside of the perimeter defined by security signal 106, security circuitry 110 instructs tool transmitter 114 to transmit theft signal 116. It should be noted that portable tool 102 can also be reset and/or overridden with a hardware or software key such that theft protection device 100 is disabled.

As illustrated in FIG. 1-2, device 100 further includes processing circuitry 118 operably coupled to transmitter 104 and external receiver 120 operably coupled to processing circuitry 118. External receiver 120 is configured to receive the transmitted theft signal 116. When external receiver 120 receives the transmitted theft signal 116, processing circuitry 118 is configured to output an audible alarm. In addition, processing circuitry 118 records in memory 122 information related to theft signal 116 for later user retrieval. For example, processing circuitry 118 can record a date and time when

portable tool 102 was stolen. Processing circuitry 118 can also record a serial number or identification number related to the particular portable tool 102 stolen based on the received theft signal 116.

Both security signal 104 and theft signal 116 can include a variety of signals. For example, transmitter 104 and tool transmitter 114 can transmit a diffused infrared signal while receiver 108 and external receiver 120 can be configured to receive a diffused infrared signal. Diffused infrared signals utilize the walls and ceilings of a room to bounce infrared signals between a transmitter and a receiver. Thus, people walking about the room as well as fixed obstructions will not interfere with sustained infrared communications. However, transmitter 104, external receiver 120 and portable tool 102 must all be located in the same room because infrared communication can not penetrate obstructions, such as walls. In another example, transmitter 104 and tool transmitter 114 can transmit a radio frequency (RF) signal while receiver 108 and external receiver 120 can be configured to receive a RF signal. In this example, transmitter 104, external receiver 120 and portable tool 102 can all be located in different rooms because RF signals can easily penetrate walls and other obstructions. Two common standards for RF communication include the Bluetooth protocol and the 802.11(b) protocol. The Bluetooth protocol is cost-effective and easy to implement.

However, the distance the Bluetooth signal covers is less than the distance covered by the 802.11(b) signal.

FIG. 2-1 is a simplified block diagram of theft prevention device 200 prior to a theft in accordance with an embodiment of the present invention. Device 200 includes transmitter 204 configured to transmit a wireless security signal 206 that defines a perimeter. Device 200 also includes a receiver 208 embedded in portable tool 202 and operably coupled to security circuitry 210. Security signal 206 can be encoded with a key such that secure communication can take place between transmitter 204 and portable tool 202. The key can be randomly changeable to ensure secure communication. Security signal 206 can also transmit other information besides defining a perimeter. Examples of other information include software updates for the portable tool, messages for the operator and time updates.

Receiver 208 is configured to receive the transmitted security signal 206. If portable tool 202 remains located outside the perimeter, then proper use and /or storage of portable tool 202 is being practiced within the automotive service center. If, however, portable tool 202 at least passes through the perimeter, a theft has occurred. For example, receipt of security signal 106 can indicate that portable tool 202 is within the perimeter defined by the security signal. In another example, receipt of

security signal 106 having a signal strength greater than a predetermined minimum signal strength can indicate that portable tool 202 is located within the perimeter. In FIG. 2-1, transmitter 204 is not in communication with receiver 208 or security signal 206 has a signal strength less than the predetermined minimum signal strength. Therefore, portable tool 102 is located outside the perimeter defined by security signal 206 and is in proper use.

FIG. 2-2 is a simplified block diagram of theft prevention device 200 of FIG. 2-1 after a theft has occurred in accordance with an embodiment of the present invention. Portable tool 202 includes an output 212 operably coupled to security circuitry 210 as well as tool transmitter 214 operably coupled to security circuitry 210. Portable tool 202 also includes an internal power source 240 configured to supply power to security circuitry 210 such that portable tool can receive security signal 206, output the continuous audible noise and transmit theft signal 216. As illustrated in FIG. 2-2, transmitter 204 is in communication with receiver 208 or security signal 206 has a signal strength greater than the predetermined minimum signal strength. Therefore, portable tool 202 has at least partially passed through the perimeter defined by security signal 206 and a theft has occurred.

If a theft has occurred, security circuitry 210 is configured to disable portable tool 202 causing

the tool to become inoperable. For example, security circuitry 110 can disable portable tool 102 after the portable tool has been outside of the perimeter for a predetermined period of time. Waiting the predetermined period of time prevents portable tool 102 from disabling if there was a temporary interruption in security signal 106. In addition, security circuitry 210 instructs output 212 to emit a continuous audible noise. This continuous audible noise will alert service center employees that portable tool 202 has been stolen and alert others outside of the service center. Furthermore, when portable tool 202 at least partially passes through the perimeter defined by security signal 206, security circuitry 210 instructs tool transmitter 214 to transmit theft signal 216. It should be noted that portable tool 202 can also be reset and/or overridden with a hardware or software key such that theft protection device 200 is disabled.

As illustrated in FIG. 2-2, device 200 further includes processing circuitry 218 operably coupled to transmitter 204 and external receiver 220 operably coupled to processing circuitry 218. External receiver 220 is configured to receive the transmitted theft signal 216. If external receiver 220 receives the transmitted theft signal 216, then processing circuitry 218 is configured to output an audible alarm. In addition, processing circuitry 218 records in memory 222 information related to theft signal 216

for later user retrieval. For example, processing circuitry 218 can record a date and time when portable tool 202 was stolen. In addition, theft signal 216 can include information related to identification of the particular portable tool 202 based on theft signal 216. Thus, processing circuitry 218 can also record a serial number or identification number related to the particular portable tool 202 stolen.

Both security signal 204 and theft signal 216 can include a variety of signals. For example, transmitter 204 and tool transmitter 214 can transmit a diffused infrared signal while receiver 208 and external receiver 220 can be configured to receive a diffused infrared signal. In another example, transmitter 204 can transmit a direct infrared signal (or beam of infrared light) and receiver 208 can be configured to receive the direct infrared signal. In another example, transmitter 204 and tool transmitter 214 can transmit a radio frequency (RF) signal while receiver 208 and external receiver 220 can be configured to receive a RF signal. Two common standards for RF communication include the Bluetooth protocol and the 802.11(b) protocol. In yet another example, receiver 208, tool transmitter 214 and security circuitry 210 can include a radio frequency identification (RFID) tag, while external receiver 220 and transmitter 204 can include a RFID reader. In this example, the RFID tag at least partially passes

through the perimeter defined by security signal 206. The RFID tag detects security signal 206 and disables portable tool 202 from operation as well as instructs output 212 to emit a continuous audible noise as described above. After the RFID reader transmits RF signals to activate the tag, the RFID reader decodes the data encoded in the tag's security circuitry. The decoded data is passed to processing circuitry 218 for identification and reporting as well as causes processing circuitry to sound an audible alarm as discussed above.

FIG. 3 is a simplified block diagram of automotive service center 324. Automotive service center 324 includes repair area 325 as well as inner office space 326. Service center 324 also includes a plurality of exits and entrances 328 around outer walls 329 of center 324. As illustrated in FIG. 3, transmitter 304 is located in repair area 325 and is transmitting a security signal (FIGS. 1-1 and 1-2). The security signal defines a perimeter represented by dashed line 330. A plurality of portable tools 302 are located about repair area 325. Each portable tool 302 receives the security signal with an receiver (FIGS. 1-1 and 1-2). If a person were to pick up at least one of the plurality of tools 302 and carry tool 302 outside of dashed line 330, then the security circuitry (FIGS. 1-1 and 1-2) of that particular portable tool 302 would disable the tool. Therefore, portable tool 302 is rendered inoperable.

In addition, the security circuitry instructs an output (FIGS. 1-1 and 1-2) to emit a continuous audible noise.

Furthermore, when a person carries at least one portable tool 302 outside of the dashed line, the security circuitry instructs a tool transmitter (FIGS. 1-1 and 1-2) embedded within portable tool 302 to transmit a theft signal (FIGS. 1-1 and 1-2). An external receiver 320 located within inner office space 326 and operably coupled to processing circuitry 318 is configured to receive the transmitted theft signal. Upon receipt of the theft signal by external receiver 320, processing circuitry 318 records information related to the theft signal as well as outputs an audible alarm. In accordance with FIG. 3, the security signal can be a diffused infrared signal or a RF signal. The theft signal can be a RF signal but not an infrared signal since infrared signal can not penetrate the walls of inner office space 326. Those skilled in the art will recognize that the theft signal could be a diffused infrared signal if the external receiver was located in repair area 325. Communication between external receiver 320 and processing circuitry 318 and between the transmitter 304 and processing circuitry can be any type of cable connection as well as any type of wireless connection.

FIG. 4 is a simplified block diagram of automotive service center 424. Automotive service

center 424 includes repair area 425 as well as inner office space 426. Service center 424 also includes a plurality of exits and entrances 428 around the outer walls 429 of center 424. FIG. 4 also illustrates a plurality of transmitters 404. Each transmitter 404 is located within each exit and entrance 428. Each transmitter 404 is configured to transmit a security signal (FIGS. 2-1 and 2-2). Each security signal defines a perimeter represented by dashed lines 430. A plurality of portable tools 402 are located about repair area 425. Each portable tool 402 is configured to receive the security signal with a receiver (FIGS. 2-1 and 2-2). If a person were to pick up at least one of the plurality of tools 402 and carry it through an entrance or exit 428, then tool 402 would at least pass partially through one of the perimeters illustrated by dashed line 430. Upon passing at least partially through one perimeter, the security circuitry (FIGS. 2-1 and 2-2) of that particular portable tool 402 would disable the tool. Therefore, portable tool 402 is rendered inoperable. In addition, the security circuitry instructs an output (FIGS. 2-1 and 2-2) to emit a continuous audible noise.

Furthermore, if a person carries at least one portable tool 402 at least partially through an entrance or exit 428, the security circuitry instructs a tool transmitter (FIGS. 2-1 and 2-2) embedded within portable tool 402 to transmit a theft

signal (FIGS. 2-1 and 2-2). An external receiver 420 located within inner office space 426 and operably coupled to processing circuitry 418 is configured to receive the transmitted theft signal. Upon receipt of the theft signal by external receiver 420, processing circuitry 418 records information related to the theft signal as well as outputs an audible alarm. In accordance with FIG. 4, the security signal can be a diffused infrared signals or a RF signal. The theft signal can be a RF signal but not an infrared signal since an infrared signal can not penetrate the walls of inner office space 426. Those skilled in the art will recognize that the theft signal could be a diffused infrared signal if the external receiver was located in repair area 405. Communication between external receiver 420 and processing circuitry 418 and between the transmitter 404 and the processing circuitry can be any type of cable connection as well as a type of wireless connection.

FIG. 5 is a simplified block diagram of an example electronic battery tester 502 with which embodiments of the present invention are useful. Battery tester 502 is a type of portable tool which couples to a battery (not shown) via connectors 532. For example, connectors 532 may provide Kelvin connections to a battery. Note that FIG. 5 is illustrative of a specific type of battery tester which measures dynamic parameters. However, in one aspect, the present invention is applicable to any

type of battery tester including those which do not use dynamic parameters. Other types of example testers include testers that conduct load tests, current based tests, voltage based tests, tests which apply various conditions or observe various performance parameters of a battery, etc.

Battery tester 502 includes test circuitry 534. Test circuitry 534 contains processor 536, security circuitry 518 and other circuitry configured to measure a dynamic parameter of a battery. As used herein, a dynamic parameter is one which is related to a signal having a time varying component. The signal can be either applied to or drawn from the battery.

Besides assisting in measuring dynamic and non-dynamic parameters of the battery, processor 536 also controls the operation of other components, such as theft prevention components, within battery tester 502. Battery tester 502 also includes output 512, tester transmitter 514 and receiver 508. Processor 536 controls the operation of these theft prevention components as well as carries out different battery testing functions. Battery tester 502 also includes internal power source 540. Generally, processor 536 draws its power from the battery being tested when in operation. However, battery tester 502 includes power source 540 such that processor 536 can control security circuitry 510, output 512, tester transmitter 514 and receiver 508 when battery tester 502 is not coupled to a battery being tested.

In some embodiments of the present invention, tool transmitter 514 is configured to transmit an infrared or RF signal and receiver 508 is configured to receive an infrared or RF signal. In this example, the theft prevention components rely on an internal power source 540 in order to complete the theft prevention operations as described in FIGS. 1-4. In other embodiments of the present invention, tool transmitter 514, receiver 508 and security circuitry 510 include a RFID tag. In this example, the theft prevention components rely on a reader to supply power in order to complete the theft prevention operations. Thus, no internal power source is needed.

Although the present invention has been described with reference to preferred embodiments, workers skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the invention.